A Comparative Analysis of Digital Technology (ICT) For Educational Development in Southern Nigeria

Imeh J. Umoren & Olowu Oluwatobi Tope
Department of Computer Science
Akwa Ibom State University
hollymehumoren@gmail.com, Tobytokpe@gmail.com
+2348036813637, +2349075718873

Elias A. Chollom,
National Open University of Nigeria (NOUN)
Abuja, Nigeria

ABSTRACT

The role of ICT is gradually becoming more relevant in the educational sector, with the advancement of technology in our present society. This research elaborates a performance evaluation of the impact of the use of ICT in education, pin pointing different public and private secondary school in the southern part of Nigeria. An Empirical Survey Analysis Approach was used to support analytical findings and investigated the performance characteristics. The evaluation framework and results obtained indicate that impact differs significantly across schools. Indeed, ICTs have the potential to effectively innovate, accelerate, enrich, and deepen skills in every facet of educational development.

Key words: ICTs, Education, schools, Influence, framework, students

ISTEAMS Cross-Border Conference Proceedings Paper Citation Format
Imeh, J.U., Olowu, O.T. & Elias, A.C. (2017): A Comparative Analysis Of Digital Technology (ICT) For Educational Development In Southern Nigeria. Proceedings of the 9th iSTEAMS Multidisciplinary Conference, University of Ghana, Legon, Accra Ghana. Pp 519-528

1. BACKGROUND TO THE STUDY

Information and Communication Technology (ICT) is one of the most important driving forces promoting educational development and economic growth in the country. During the last two decades, countries have invested heavily in ICT. Indeed, the use of ICT in education and training has been a key priority in most developed and developing countries in the last decade, although progress has been uneven. In Nigeria, some private schools (secondary and tertiary) have embedded ICT into the curriculum, and demonstrate high levels of effective and appropriate ICT use to support teaching and learning across a wide range of subject areas. However, most public schools are in the early phase of adopting ICT, characterized by important enhancements of the learning process, some developments of e-learning (ICT-enabled learning), but without any profound improvements in learning and teaching (Balanskat et al., 2006). There is need therefore to examine the efficiency of ICT use and its impact on educational output and outcome. As ICTs are being increasingly used in education, indicators to monitor their impact and demonstrate accountability to funding sources and the public are ever more needed.

Today, computers are ubiquitous in developed country schools and universities and are rapidly spreading to developing country classrooms. Many learning tools have been developed for these computers, from learning games to computer assisted instruction (CAI) software to teacher assisting software. Schools are connected to the World Wide Web (WWW), and students even in remote areas can have access to increasing amounts of information previously available only to populations living near large city and university libraries.

Through the Web, teachers and students can access curricular, teacher training, and other learning materials, some provided by their own central or state government administrations, and others through private providers. ICT is being used in distance education to replace earlier correspondence school and educational television. The new distance education is usually Web-based. Computers are also ubiquitous in educational administrative offices .Even before desktop computers became widely used in business in the 1980s, ministries, state offices of education, universities, and school districts used computers to store information about students including school personnel. The use of computer systems is recommended for linking local, regional, and central administrative offices and for collecting and analysing information about system performance. With all this computer-based technology already in school systems and universities, there is urgent need to observe some major changes in the way education is managed, the way work is organized in the education industry, and the way young people learn. Most analysts agree that the changes are much smaller than expected, yet that the potential for change is great.

1.1 Factors Influencing the Use of ICT

Factors influencing the use of ICT can be divided into external factors and internal factors. The two types of factors are related to each other and to ICT usage level (Tezci 2011). A variety of external factors have been identified that influence the effectiveness of technology integration in schools. These include technology availability, accessibility of ICT equipment, time to plan for instruction, technical and administrative support, school curriculum, school climate and culture, faculty teaching load and management routine, and pressure to prepare students for national entrance exams (Al-Ruz and Khasawneh 2011; Lin, Wang and Lin 2012; Tezci 2011). Among these external factors, the most common are lack of access to computers and software, insufficient time for course planning, and inadequate technical and administrative support (Chen, 2008). Al-Ruz and Khasawneh (2011) found that some external factors were positively associated with technology integration, including availability of technology ($r = 0.39$, $p < 0.01$) and support from technicians, teachers, and principals ($r = 0.44$, $p < 0.01$). Thus, technology availability and overall support are important to technology integration. The higher the support structure and technology availability, the higher the technology integration efforts are made by teachers.

Several internal factors also influence technology integration outcomes (Sang et al. 2011). Internal factors related to teachers include: understanding of ICT use; beliefs, which may conflict with the application of ICT; attitudes toward technology integration; perceptions, including intention or motivation to use ICT; self-confidence and knowledge; technology skills; readiness to use ICT; and technology self-efficacy (Al-Ruz and Khasawneh 2011; Chen 2008; Lin, Wang and Lin 2012; Sang et al. 2011; Tezci 2011). Chen (2008) discovered two common issues associated with internal factors. First, teachers may implement policies based on limited or improper theoretical interpretations and comprehension of ICT use. Second, teachers may be under pressure to cover all content and be unwilling or hesitant to let students spend more time exploring content on their own with technology due to their other conflicting beliefs. These issue simply that teacher beliefs may not resonate in their practices. A school culture emphasizing competition and a high stakes assessment system can discourage teachers from integrating technology into their classrooms. Thus, teacher beliefs influence ICT use in the classroom (Chen,2008).ICT, therefore, will not in itself prove effective in the classroom without teachers who possess knowledge of both the technology and how to use it to meet educational goals (Koc, 2005).

However, there has been meager research into the possible relationships between external and internal variables, and how these relationships differ according to the variables involved in ICT integration. Examining these relationships could not only help teachers, students, and administrators understand the challenges of ICT use better, it could also assist them in uncovering other solutions to overcome the existing barriers based on the relationships among different variables. A review of the existing literature makes it apparent that ICT integration entails an evolving process, not a final product. To achieve successful integration of technology requires an effort from three sides: teachers, students, and school administrators. This critical review discusses the current situations, barriers to, and solutions for ICT integration in the classroom. Furthermore, the possible gaps in the existing literature are shown in order to provide lucid directions for future research into ICT use.

1.2 ICT and Students' Performance

Since the Internet revolution, there has been a shift in the literature that focuses more on the impact of online activities: use of Internet, use of educative online platforms, digital devices, use of blogs and wikis. This literature shows mixed results. On one hand, some research demonstrates that there is no evidence of a key role for ICT in higher education (Angrist and Lavy, 2002; Banerjee et al., 2004; Goolsbee and Guryan, 2002; Kirkpatrick and Cuban, 1998). Leuven et al. (2004) concluded that there is no evidence for a relationship between increased educational use of ICT and students' performance. In fact, they find a consistently negative and marginally significant relationship between ICT use and some student achievement measures.

Students may use ICT to increase their leisure time and have less time to study. Online gaming and increased communications channels do not necessarily mean increased achievement. Many other explanations were presented. On the other hand, some studies show a real impact of ICT on students' achievement (Kulik, 1999; Sosin et al., 2004; Fushs and Wossman, 2004; Coates et al., 2004). Kulik's (1994) meta-analysis study revealed that, on average, students who used ICT-based instruction scored higher than students without computers. The students also learned more in less time and liked their classes more when ICT-based instruction was included. Fuchs and Woessman (2004) used international data from the Programme for International Student Assessment (PISA). They showed that while the bivariate correlation between the availability of ICT and students' performance is strongly and significantly positive, the correlation becomes small and insignificant when other student environment characteristics are taken into consideration.

The analysis of the effects of these methodological and technological innovations on the students' attitude towards the learning process and on students' performance seems to be evolving towards a consensus, according to which an appropriate use of digital technologies in higher education can have significant positive effects both on students' attitude and their achievement. Attwell and Battle (1999) examined the relationship between having a home computer and school performance, for a sample of approximately 64,300 students in the United States. Their findings suggest that students who have access to a computer at home for educational purposes, have improved scores in reading and maths. Coates et al. (2004) showed that students in on-campus courses usually score better than their online counterparts, but this difference is not significant here. Li et al. (2003) pointed out: "First, web-based instruction presents information in a non-linear style, allowing students to explore new information via browsing and cross-referencing activities. Second, web-based teaching supports active learning processes emphasized by constructivist theory. Third, web-based education is enhanced understanding through improved visualization and finally, the convenience, it could be used any time, at any place".

1.3 Summary of Review

The potential benefits, implications and challenges of introducing ICT into schools can be very different depending on the vision and the understanding of the nature of this change, as well as strategies for its management adopted by the leadership at the school level and beyond (UNESCO, 2003). The adoption and use of ICTs in education have a positive impact on teaching, learning, and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching- learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for learners and teachers. These possibilities can have an impact on student performance and achievement. Similarly, wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching and improved academic achievement of students. The overall literature suggests that successful ICT integration in education is beneficial to both the students and teachers alike. Thus, this study intends to further improve the use of ICT for educational development by developing a framework that bridge the digital divide between male and female students in secondary schools.

2. STATEMENT OF PROBLEM

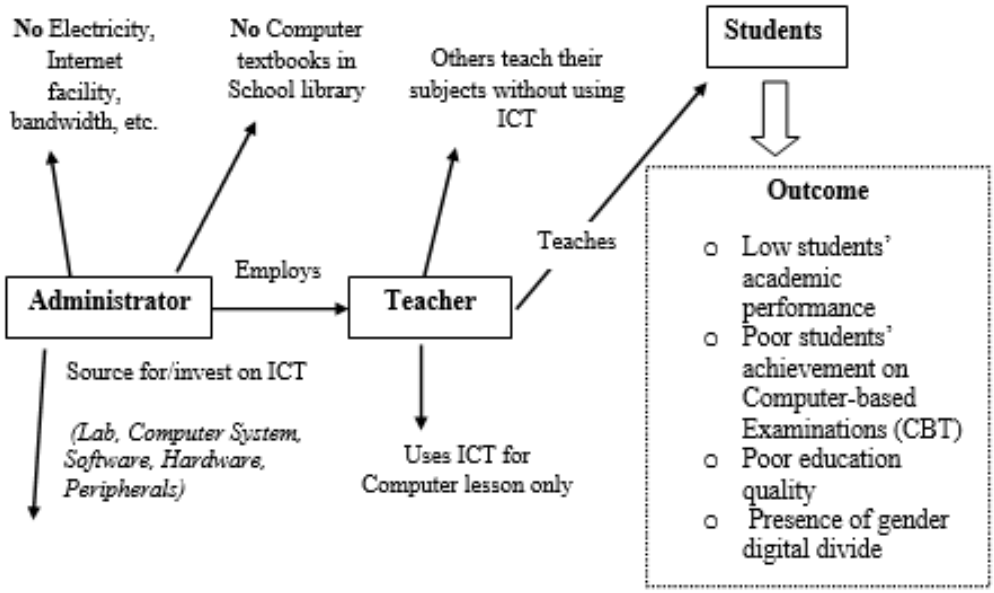

Fig. 2.1: Conceptual Architecture of Existing Educational System

3. OBJECTIVE

The focus of this research is to evaluate the performance of digital technologies on education development to ascertain its impact on student academic achievement in selected secondary schools in Southern Nigeria.

4. METHODOLOGY

The methodology consists of evaluating the effect of the educational inputs (characteristics and attitudes of the teachers, physical resources committed in the schools, the teaching organization, the rate of students framing, etc.) on the students' performance by taking into account other inputs (socio-economic origin, characteristics and attitudes of the students). The findings will indicate any consistent trends and provide evidence on the relationship between educational environment (class size, physical investments in ICT, etc.), students' characteristics(age, gender, family structure, level of parents' education, geographical area, etc.), teachers' characteristics (qualification, years of experience, etc.) and performance of students. Data was collected from respondents (students/teachers/administrators) through structured, validated, pre-test questionnaire survey method using stratified random sampling of selected schools in Southern Nigeria as study area.. The content validity and reliability of the instrument was ascertained by research partners and domain experts. Statistical Package for the Social Sciences (SPSS) software tool was used for data analysis and evaluation. Descriptive statistics, composite index analysis, t-test, Pearson correlation, and Analysis of Variance (ANOVA) were performed on the dataset.

4.1 Methods of Data Collection

The study was carried out in selected secondary schools in Southern Nigeria, where the people's occupation is predominantly fishing, farming, and trading due to the coastal nature of the terrain. The data of the study was primary data from a field survey obtained based on multistage sampling technique. A random sample of 350 respondents selected from various secondary schools including public and private secondary schools in the study area was used. At stage one, the purposive sampling technique was adopted for selecting seven public and three private secondary schools on the basis of population, date of establishment, and location of secondary schools. At stage two, the researcher stratified the respondents into different strata of gender, educational

qualification, location of residence, and age. At stage three, the researcher employed simple random sampling technique to select 350 secondary school students, teachers and administrators from both public and private secondary schools comprising 194 males and 156 females. Of the 194 males, 170 were students, 18 were teachers and 7 were administrators. Of the 155 female, 130 were students, 20 were teachers and 5 were administrators. The researcher personally administered the questionnaire with an instruction to the respondents that the exercise was purely for research purpose.

5. DATA PRESENTATION AND DISCUSSION

Table 5.1: Demographic Characteristics of the Respondents

S/N	Item Grouping	Frequency	Percentage
1	Sex		
	Male	194	55.4
	Female	156	44.6
2	Status		
	Student	300	85.7
	Teacher	38	10.9
	Administrator	12	3.4
3	School Type		
	Private	247	70.6
	Public	103	29.4
4	Locality of Residence		
	Semi-urban	41	11. 7
	Urban	292	83.4
	Rural	17	4. 9
5	Age		
	11- 14	99	28.3
	15-20	202	57.7
	21-25	8	2.3
	26-30	19	5.4
	31-39	16	4.6
	40+	6	1.7
6	Educational Level		
	JSS	10	2.9
	SSS	305	87.1
	HND/BSc	27	7.7
	MSc	5	1.4
	Others	3	0.9
7	Household Size		
	2-5	228	65.1
	6-9	114	32.6
	10-15	8	2.3

There is no significant relationship between the use of ICT and students 'academic performance. Results from table 4.2 indicate that the ability to use computer and other ICT devices to solve problems, search or surf the Internet for needed information or digital resources through search engines, and browse through Facebook, online chatting or games together account for 33.3% of students' academic performance (R2 = 0.333). However, this percentage is not too high as expected and significant. This implies that the three independent variables are predictors of students' academic performance

Table 5.2: Relationship between the Use of ICT and Students' Performance

R = .577

R^2 = 0.333

Adj. R^2 = 0.327

Standard Error = 1.183

ANOVA

Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Remark**
Regression	241.410	3	80.470	57.456	.000	Significant
Residual	484.590	346	1.401			
Total	726.000	349				

Significant (P<0.05)

Furthermore, results show the predictors' variables in the model, the beta values and the significant t-values corresponding to each of the variables against the criterion variable (students' academic performance). Results from table 4.3 indicate that the beta value for using the computer to solve problems (â = .441; t =8.909; P<.05) and search for needed information (â = .159; t =2.620; P<.05) are significant, while the ability to browse through Facebook, online chatting or games (â = .083; t =1.434; P<.05) is not significant at an alpha level of 0.05. This implies that students' academic performance is positively related to the ability of using computer and other ICT devices to search with search engines and solve problems but not with the ability to carry out online chatting, Facebook, and play computer games.

Table 5.3: Contribution of each Variable to Students' Performance

Model	Unstandardized co-efficient		Standardized co-efficient	T	Sig.
	B	Std. Error	Beta		
Use of Search Engines	.139	.053	.159	2.620	.009
Browse with Facebook	.079	.055	.083	1.434	.152
Use computer to solve problems	.436	.049	.441	8.909	.000

Results from table 4.4 indicate that having better grades correlates significantly with the ability to use computer to search information from the Internet (r = .411, P<0.05) and solve problems (r =.542, P<0.05) than with to browse (r=344, P<0.05). However, having better grades does not correlate with educational level (r=.068, P<0.05), household size (r=.023, P<0.05) and type of residence (r=.042,P<0.05) but ability to solve problems correlate with educational level (r=.113, P<0.05), searching Internet, browsing, and better grades but not with others while ability to search the Internet correlates with educational level and type of residence, among others.

Table 5.4: Correlation Matrix of the independent variables on Students' Academic Performance

Variables	Edulevel	Housize	Residence	Search	Browse	Solvpro	Betgrd
Edulevel	1	.061	.097	.201**	.227**	.113*	.068
Housize	.061	1	.001	.008	.122*	.006	.023
Residenc	.097	.001	1	.173**	.136*	.092	.042
Search	.201**	.008	.173**	1	.647**	.451**	.411**
Browse	.227**	.122*	.136*	.647**	1	.359**	.344**
Solvpro	.133*	.006	.092	.451**	.359**	1	.542*
Betgrd	.068	.023	.042	.411**	.344**	.542*	1

N = 350
** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

In summary, it was observed that students' academic performance is shaped by a wide range of factors. The use of ICT amounted to 33.3% of students' academic performance, although a larger percentage (66.7%) could not account for it. It is clearly shown that the variance contribution is strong indicator that the use of ICT devices can greatly enhance students' academic performance.

There is no effect of ICT investments on students' academic achievement. Results indicate that ICT investments in the form of a computer laboratory, Lab with internet access, presence of electricity, use of lab for practicals taken together account for 19.8% (R2 = 0.198) of students' academic achievement thereby helping the students to make better grades. However, this percentage is not too high as expected and significant as shown in table 4.5.

Table 5.5: Effect of ICT investment on students' academic performance

R = .455
R^2 = 0.198
Adj. R^2 = 0.189
Standard Error = 1.299
ANOVA

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Remark**
Regression	144.013	4	36.003	21.343	.000	Significant
Residual	581.987	345	1.687			
Total	726.000	349				

Significant (P<0.05)

Results on table 4.6 further indicate that the use of computer laboratory for practical with appropriate hardware and software materials by qualifying personnel (â = .279, t = 3.058, P<0.05) and the availability of internet access (â = .154, t = 2.136, P<0.05) in the laboratory as ICT investments are highly significant in helping students achieve better grades while the presence of PHCN electricity are somewhat significant (â = .119, t =1. 833, P<0.05) since there are other electricity sources like generating plant, solar energy, etc that can complement it. These results clearly show that ICT investments are strong indicators of students' academic achievement. However, just having computer laboratory in the school is not significant (â = .049, t =.501, P<0.05) to students' academic achievement. Therefore, the null hypothesis that there is no effect of ICT investment on students' academic performance is rejected.

Table 5.6: Contribution of each ICT investment on Students' achievement

Model	Unstandardized co-efficient		Standardized co-efficient	T	Sig.
	B	Std. Error	Beta		
Presence Computer Lab	.047	.094	.049	.501	.616
Lab with Internet Access	.139	.065	.154	2.136	.033
Use of Lab for computer practicals	.250	.082	.279	3.058	.002
PHCN Connection	.119	.065	.119	1. 833	.068

6. CONCLUDING REMARKS

In conclusion, results from findings indicate that there are institutional barriers with regard to end-user ICT skills development. These includes possession of small computer laboratories with few computers connected with internet; lack of ICT training materials like manuals, brochures, leaflets, CDs and DVDs; lack of qualified ICT trainers; and lack of support from school management. The proportion of students with appropriate end-user ICT skills including searching, evaluation and ethical use of information was very small.

If Nigeria is to be a world leader in ICT, greater urgency is required. In terms of relative importance, it is important to reiterate the point made previously that all developments depend on access to reliable networks, hardware and software. Obviously increased access to reliable systems cannot occur in the absence of better decision-making and more effective investment. Finally, the architectural design in this work anticipates support and improvement in these areas to achieve the various goals. Some of these goals include:

1. more informed decision-making by all stakeholders in the education system;
2. more effective and efficient investment in ICT by education sector and government agencies;
3. increased access;
4. Increased capacity through ICT use for all stakeholders (government, administrators, teachers, students, etc.);
5. greater opportunities for generating, applying and sharing ideas and technologies; and
6. A more learner-centred education system.

7. RECOMMENDATIONS

The empirical results show that the efficiency of ICT, when taking educational outputs into consideration, differs significantly across the great majority of public schools. Therefore, a significant increase in ICT expenditures/investment is needed in those schools. Finally, the performance evaluation finds evidence that most of the private schools under consideration hold great potential for increased efficiency in ICT and for improving their educational outputs and outcomes. Basically, it is believed that when students become information literate, they develop inability to select, interpret, evaluate, manipulate and present information. The following recommendation is thus made.

Educational institutions should integrate end-user ICT skills within the curriculum. This will enable teaching and assessing such skills like any other subject.

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